

-Meeting Summary-

Day 1: January 12, 2011 - (8:30 a.m. – 5:00 p.m.)

1. Welcome and Introductions

The meeting was called to order at 8:30 a.m., January 12, 2011, by the Chair of the Delta Independent Science Board (Delta ISB), Dr. Richard Norgaard. Eight members of the Delta Independent Science Board were present for the meeting: Tracy Collier, Edward Houde, Michael Healey, Judy Meyer, Jeffrey Mount, Richard Norgaard, Vince Resh, and John Wiens. Brian Atwater and Elizabeth Canuel were absent.

Public Correspondence

Paul S. Weiland, Attorney at Law with NOSSAMAN LLP sent an email to Cliff Dahm, Lead Scientist for the Delta Science Program, on January 7, 2011 requesting that his email and corresponding attachment be shared with the members of the Delta ISB. It was noted that the email and attachment would be distributed to the Delta ISB via email later that day, and posted to the Delta ISB Correspondence webpage.

Board Member Disclosures

There were no changes or additions to previous disclosures made at the Sept 30 – Oct 1, 2010 Delta ISB meeting.

2. Purpose and Format of the Workshop

Norgaard stated that the purpose of the workshop is to evaluate multiple stressors to the California Delta, in response to requests from some members of the California Senate, Assembly and the Delta Stewardship Council (Council); and to identify alternative classifications of stressors and ways of evaluating their relative importance, especially when considering interactions of multiple stressors. Norgaard also noted that he believed that stressors cannot be ranked before you rank what it is that is being stressed.

Cliff Dahm, Lead Scientist for the Delta Science Program, provided additional opening statements citing publications by Jim Cloern (2001), Schindler (1997) and Vosomarty (2010). In each of these publications, the authors identified various categories of stressors as well as individual stressors. Dahm explained that climate change is one overriding stressor, and referenced papers in *Nature's* September 2010 issue: Rivers in Crisis. He also mentioned various means of categorizing stressors such as those that are not static in space and time, stressors that can be manipulated, etc. He closed with a quote from Jane Luchenko, "Meaningful change is not for the timid."

3. Invited Participants' Introductory Statements

All the invited participants were requested to provide some introductory remarks, five-to-seven minutes in length. Their statements were also to include answers to the following two questions that were sent to them prior to the workshop:

- Is it feasible to subdivide the multiple stressors affecting the Delta into groups or classes according to their importance in meeting the objectives of ecosystem restoration and reliable water supply while protecting the unique values of the Delta; and
- What methodologies are appropriate for making such a subdivision?

Bruce Herbold (U.S. Environmental Protection Agency): Those working on the Pelagic Organism Decline (POD) have moved away from using the word 'stressors' and use 'drivers' instead, because some things are driven up and others driven down. He also noted that predation by other fish gear up and down as a function of water temperature.

Ted Sommer (California Dept. of Water Resources): Recent IEP reports (2007 and 2010) provide a good information base. Need to have clearly defined goals. The POD team has tried to use a statistical approach to evaluating stressors and has stayed away from ranking them for a number of reasons including uncertainty. They also focus on single species, an approach not suited for managing the entire ecosystem. He expressed concern about ranking stressors for several reasons including uncertainty.

Anke Mueller-Solger (Delta Stewardship Council): POD initially focused on four species and then shifted to looking at the ecosystem as a whole, which has led to the belief that there is an ecosystem regime shift. She cautioned the group to remember the effects of globally scaled problems.

Victoria Poage (U.S. Fish and Wildlife Service): The US Fish and Wildlife Service (USFWS) calls stressors 'threats'. The recovery planning process focuses on identifying those threats and then developing recovery actions to deal with them. The five factors used by the USFWS to evaluate a threat are: habitat, use, disease or predation, regulatory mechanisms, and other man-made factors. The USFWS performs evaluations using a life history context, develops a matrix of stressors and then ranks them. The USFWS is striving to make the process more holistic.

Steve Lindley (National Oceanic and Atmospheric Administration, Southwest Fisheries Science Center): Drivers give rise to stressors. The stressors are put into groups and then plugged into landscape level models; this approach takes a long time to do but may provide a potential framework.

Perry Herrgesell (California Dept. of Fish and Game): Referenced the report he wrote for the California Department of Fish and Game (DFG) on stressors. (December 2010 Report to the California Fish and Game Commission on Stressors.) Stressors can be subdivided into groups;

DFG developed three priority groups and used different criteria for each group. Priority 1 stressors have the greatest potential to impact all or almost all of the species of interest, there is an urgency to do something now, or is a stressor with a high level of uncertainty; Priority 2 stressors affect 1 or 2 species; and Priority 3 stressors have localized effects on one species.

Valerie Connor (State and Federal Contractors Water Agency): It is possible to develop species-specific life history models to look at impacts of stressors as hypotheses. Such models look at effects hierarchy, path analysis, direct effects and dependent variables. These types of models need a lot of data, focus on mechanisms of effects, and are a way to factor in density dependence.

Jon Rosenfield (The Bay Institute): The logic chain structure used in the Bay Delta Conservation Plan (BDCP) takes a species-by-species approach. This is particularly helpful in the Delta system where there are lots of species that need help that have very different life stages, problems, and goals (attributes of viability). Stressors are related to the goal and you need to ask why that goal is not being met. One should also pay attention to those stressors over which one has no control. It is best to identify stressors that have multiple solutions. Stressors should not be considered mechanisms as there are stressors that drive other stressors.

Diana Engle (Larry Walker Associates): Made five broad comments that relate to weighting stressors: 1) draft the list of stressors; 2) clearly articulate goals; 3) develop potential prioritization schemes that can be used and include life history conceptual models, or a matrix with spatial and temporal components; 4) use strength of evidence to rank stressors; and 5) identify stressors with indirect impacts.

Pete Smith (U.S. Geological Survey - retired): Ranking of the stressors to the Delta needs to be done. Ranking is a function of best professional judgment.

Jay Lund (U.C. Davis): What you say about stressors relates to your goals which are: 1) civilize the conversation and educate; 2) better understand how the Delta has changed and how it will change; 3) develop a better understanding of technical ways that could be implemented; 4) prioritize the more effective ways of going to the future; and 5) help allocate responsibility for funding future actions. We need to move beyond a list of stressors. Work and discussions of Delta stressors should be organized, specifically to aid with the objectives to be accomplished, and how the problem is organized affects the answer that is developed. An organization of the complexity of this topic should be the objective. A two-page handout was provided: "Thoughts on Delta Stressors," by Jay Lund, January 11, 2011.

Stephen Wheeler (U.C. Davis): Recommended that the problem be framed broadly and in a way that the public can understand. Three things that should be considered in relation to stressors: 1) the role of the Delta, as a rural island, in a rapidly growing mega-region, 2) the Delta as a unique place due to its 19th century history and landscape, and 3) the influence of climate change and

sustainable planning of the Delta. He also recommended that the Delta ISB think about the human aspects in their evaluation and respond in a way that the public understands and cares about it.

Norgaard concluded this portion of the agenda by reminding the Delta ISB to keep larger drivers and goals in mind.

4. Delta ISB Members' Assignments

Members of the Delta ISB were also asked to provide answers to the two questions posed to the invited participants (listed under agenda item 3 on day one); and to provide a brief overview regarding topic areas they had been assigned to review at their December 2010 meeting.

Norgaard: (assigned topic: National Research Council) No news regarding activities of the National Research Council. He noted that drivers seem to describe something more perennial versus the term stressors describing something that might go away.

Healey: (assigned topics: BDCP Logic Chain and Delta Regional Ecosystem Restoration Implementation Plan (DRERIP) approaches; Environmental Protection Agency (EPA) & Causal Analysis/Diagnosis Decision Information System (CADDIS); and POD.

- DRERIP and EPA: With both these approaches classification is possible, but it is a subjective classification based on expert judgment. Using expert opinion in the Delta is difficult due to conflicting opinions and vested interests. The DRERIP links restoration actions to desired outcomes.
- EPA and CADDIS: both are used for identifying and classifying stressors. The package is quite useful, especially the first volume, which characterizes the impairment, lists causes and stresses, assembles them using conceptual models, and then decides which stressors are the most likely to cause the impairment. The EPA tool kit is well organized and covers basics but is weak on using interacting stressors.

Overall, the CADDIS and DRERIP conceptual models are useful in analyzing and exploring stressors, but neither is the final answer to the problem.

Mount: (assigned topics: BDCP, Logic Chain and DRERIP approaches; POD; and Levees) POD and BDCP: Both approaches responded to multiple stressors. POD's new approach is to view what is happening as a regime shift (a fundamental change in the Delta as major drivers tipped it to a new system which may be unfriendly to the native species). Slow drivers were ranked; it was not clear how this was done, in order of importance: outflow, salinity, landscape, temperature, turbidity, nutrients, contaminants, harvest losses (fish mortality). BDCP: Specifically links goals and objectives with stressors. They identified 14 stressors and put them into two groups – 10 of the stressors have conservation outcomes, including passage, stranding and dredging. Neither BDCP nor POD consider landscape aspects, yet 95 percent of wetland and floodplains are gone

and there is massive infrastructure. Plus there is a need to deal with legacy stressors (e.g., miles of levees) that will be hugely expensive to do and for which the response time will be long. How the Delta will change over the next 50 years needs to be considered; this is a human system, not just an ecosystem.

Collier: (assigned topics: Biological Opinions and Recovery Plans and Puget Sound Partnership) Puget Sound Partnership: They are in the middle of developing a framework for dealing with multiple stressors, and are doing so as an open standards process with attributes of systems and targets (they call targets “threats”). Two stressors that they consider very high are climate change and development. They are watching our process as they want to know how we are going to approach it. With multiple stressors at work good food web models are critical. Meyer commented on Collier’s Puget Sound Partnership summary stating that the area was divided into regions and each region had an action plan using open standards. The Partnership is attempting to use consistent terminology and is finding that the process of applying open standards is extremely frustrating.

Recovery Plans and Biological Opinions: The Puget Sound Partnership has a state-driven governance structure and uses an Open Standard for the Practice of Conservation, similar to the EPA logic model. They are not able to describe the uncertainties associated with their assumptions. The process is not transparent or inclusive when ranking stressors. He stated that each stressor should be looked at with respect to scope, severability and reversibility. An example from Puget Sound is the recovery plan for *Orca* that has a small population of less than 100 individuals. For *Orca* there are three bins of threats: 1) vessel interactions, 2) availability of prey, and 3) pollutants. The recovery plan is focused on determining management actions based on these three threats, and the main focus is now on vessel interactions because the other two threats require a lot more interaction with multiple parties. Basically, the strategy is to target the easiest actions first. Lindley commented on how to assess threats to species and provided the following link to a PowerPoint presentation on how the USFWS assesses threats to species: <http://alaska.fws.gov/fisheries/mmm/seaotters/swaksort/ThreatsAssessment.pdf>

Meyer: (assigned topics: EPA & CADDIS; Puget Sound Partnership; and Florida Everglades) Florida Everglades: Meyer reviewed an article by Gentile et al 2001 where they reported on a model addressing the relationship between stressors and management objectives. The Governor’s Commission (Florida) set high level goals and then developed two sets of conceptual models. The first model was a societal model that delineated the drivers or societal activities that result in the creation of environmental stressors. In this case, that model identified water demand and disposal as being of primary importance. The second set of conceptual models was ecosystem models developed for 20 different landscape units in the region. The lowest tier of the societal model was a set of environmental stressors that form the upper tier of the ecological model demonstrating a key linkage between the ecological model and potential management actions.

Vince Resh: (assigned topics: Slow Stressors/Multiple Stressors; Japanese Rivers; European Rivers; Marine Systems; Australia (Healthy Waterways)) In looking at multiple stressors or slow stressors there are different methods of assessment. Comparative - a single worse stressor; versus Additive - stressor effects are built on one another; versus Multiplicative - one stressor is further modified by the presence of a new stressor. The effects of the stressors can be synergistic which produce positive expected results, or antagonistic which produce negative expected results.

North Europe: They looked at the biological traits of 600 aquatic species to determine patterns when multiple stressors were involved. It was a literature based analysis using multiple lines of evidence and causal criteria. They were able to find patterns and trends. For example, navigation was the biggest stressor in those rivers that had navigation. Multiple lines of evidence are used in epidemiological studies and the POD data would be ideal for this type of analysis. The analysis involves first assessing, does X affect Y? Then, to make that assessment, a conceptual model showing cause and affect linkages is developed. The CADDIS approach developed by EPA has an improved weighting of evidence focused on determining causation. This is used for water quality and flow alterations. There is an ongoing effort to use tools like CADDIS for analysis of POD data.

Wiens: (assigned topic: Terrestrial) The Delta ISB needs to think precisely prior to categorizing and prioritizing. For example, is urbanization a stressor or a source of stressors? Ecological risk analysis may also be helpful as it evaluates the magnitude of the stressor(s). Stressors are not constant as the systems within which they operate are dynamic. Multiple stressors have multiple targets at multiple scales. It should also be noted that aquatic systems are interspersed with non-aquatic systems therefore the terrestrial (dry land) portion of the Delta is a critical part of the system.

Houde: (assigned topic: Chesapeake Bay) Chesapeake Bay vs. Bay-Delta: The Bay-Delta has more problems than the Chesapeake but perhaps also has better institutional management. The Bay-Delta does not have important commercial fisheries like the Chesapeake does. Chesapeake Bay restoration efforts are being undertaken by the EPA due to multi-jurisdictional boundaries. Chesapeake Bay is subject to Total Maximum Daily Loads (TMDLs) that are implemented in a regulatory framework. Ecosystem based models (Ecopath, Ecosim) are used.

Delta ISB Members' Assignments Public comment:

B.J. Miller, *San Luis & Delta Mendota Water Authority*: There are three problems: 1) conflict between fish and water deliveries, 2) potential of seismic risk, and 3) drinking water quality. The possibility that there may not be multiple factors (stressors) at work, rather that there may only be one or two, needs to be considered.

Mark Rentz, *Association of California Water Agencies*: Posed several questions including how the Delta ISB will be addressing stressors outside the Delta, if at all. An example of such a stressor would be predation outside the Delta that influences Delta species. He also asked if there

should be a financial component in the analysis. Rentz recommended that the Delta ISB look at conceptual models from outside of the ecological world, such as military multivariate models, industrial multi-variable models critical to manufacturing, and USFS multi-resource modeling for forest planning.

5. Discussion (All)

Healey initiated this agenda item by asking all the invited participants and the Delta ISB members the following question:

- What is the one single piece of advice regarding stressors that you would give to the Council?

The invited participants and the Delta ISB provided answers, some of which included identifying the environmental goal first which will then allow the identification of the stressors. Other answers included: be realistic, start with the natural stressor regime, develop clear conceptual models, consider constraints on future stressors, include monitoring and research, be clear about the degree of uncertainty associated with decisions, and be cognizant of the current regulatory environment.

Healey provided a summary of what he heard, which he felt was expressed with four simple bullets:

- Have clear goals.
- Identify how to break down the impediments to achieve the goals.
- Be bold and prioritize, develop and use good conceptual models.
- Understand that the Delta will change.

Meyer proposed discussing the prioritization criteria that should be used. She suggested categories such as immediate need, broad or narrow impact, continuous vs. only now and then, and impacts on important parts or species of the system.

Mount suggested that the Delta ISB should be looking at prioritization from the point of view of the Delta Stewardship Council which is that in order to prioritize you first need to categorize. With that in mind, he suggested five “bins” to sort or categorize the stressors into:

1. Exogenous: Cannot do anything about these things but adapt (examples: sea level rise, changes in tides, long-term meteorological cycles, short-term meteorological cycles, etc.).
2. Legacy: Things done a long time ago cannot ascribe blame, but can require long-term investment in modifying the system (examples: contaminants in sediment—can reduce their effect, and large footprint of the water supply system—levees, reclamation, flood control system, rim dams).

3. Operations: The things we do regularly (examples: flood control system, water management system, dam operations, diversions, hatcheries, inputs to the systems, farms, land use and urban development).
4. Endogenous: Invasive species and things that management can change (example: ship ballast water).
5. Future stressors (examples: population growth, second homes, pollutants).

Several agreed with this “bin” approach and added that there could be another level of categorization based on “A Report to the California Fish and Game Commission on Stressors Impacting Delta Related Organisms” by Perry Herrgesell. In his report, Herrgesell used three priority levels to categorize stressors:

1. Stressors that have the greatest potential impacts and affect all aquatic resources. Therefore, there is great urgency to develop and implement corrective actions to mitigate these stressors’ effects.
2. Stressors that are thought to be less pervasive and have more species specific impacts.
3. Stressors that are localized to smaller geographic areas or affect only certain species or only a few species.

Rosenfield suggested that the prioritization criteria from Herrgesell’s report could be used in a matrix or spreadsheet where the rows have the listed stressors and the columns show the criteria that might be used for evaluation. After some discussion the following additional criteria were suggested: Breadth of Impact, Urgency, Certainty, Resiliency, Adaptive Capacity, Responsiveness, and Cost.

Norgaard stated that there is also a need to focus on Delta as a place and terrestrial systems. The Delta Plan can potentially put limits on future stressors or projected unknowns – so criteria for managing urbanization could be established.

Herbold stated that the Delta ISB should consider not only protecting and restoring resources now, but also plan for the future, as it is known that there will be future issues as a result of additional invasive species as well as levee structure and safety issues.

Wiens stated that the Delta ISB needs to keep their focus on stressors and how to address them. He felt that the Delta ISB should keep the assignment as currently posed, listing stressors and prioritizing them.

Healey next asked the invited participants and Delta ISB members what the three major obstacles to achieving the Delta Stewardship Council’s coequal goals might be. The following is a collated list.

- Loss of riparian and dendritic structure due to infrastructure—some of which could potentially be reconstructed

- Reduction of Delta outflows
- Species invasions
- Flows in general (seasonality, magnitude)
- Limitations to species distributions
- Ever shifting human plan for the Delta
- Infrastructure changes in the Delta
- Entrainment (particularly of Delta smelt) shows the need for wet years with turbid conditions
- Increased concentrations of contaminants due to the loss of high quality water that could occur due to an isolated facility
- Altered hydrograph (magnitude, timing, frequency, rate of change, duration) – need to re-establish a flow regime that is closer to the natural hydrograph
- Four habitat types need to be restored that were naturally present – lakes, off channel riparian, and freshwater and salt water tidal marsh
- Nutrient loading
- Climate change and its associated effects
- Land use/demographics/increasing urbanization
- Decline in the public's faith in government, education, science
- Altered food webs – changing chemistry, nutrient loading, and invasive species
- Three functional ecosystem attributes need to be restored which are complexity, connectivity, and hydrologic variability. The water supply is a rigid system prone to failure due to earthquakes and climate change. The point of diversion is a fundamental problem
- The loss of shallow water rearing habitat for salmon, increasing non-native predators, and altered hydrodynamics in the San Joaquin river system.
- Endangered Species Act requirements
- Human desire for control and constancy regardless of changing environmental conditions
Using measurements collected during one period of time and then applying that information across a larger time period, when conditions have changed
- Water project operations, nitrogen/ammonia cycle, and invasive species all leading to changes in the food web
- Largest obstacles are social – have to choose to take action
- Lack of regional water self sufficiency
- Potential catastrophic levee failure

Healey asked if anyone had one closing comment; those comments are summarized below:

Wiens stated that the Delta ISB should be careful about how things are labeled as stressors. For example, many include flows as an obstacle/stressor, when water operations are actually

a source of stress as demonstrated by salinity intrusion which is a consequence of flow alteration and therefore a stressor.

Rosenfield stated that the Delta is a complex system that is interwoven and it will be difficult to sort the stressors in a linear way.

Collier asked if it would be more effective to look at existing tools/approaches and modify them, rather than create new ones.

Dahm stated that the Delta ISB was constituted to bring new and legacy perspectives and world class thinkers to work on these issues.

6. Summarize the day's discussions and identify Next Steps

Mueller-Solger was pleased that there was agreement on the need to understand the goals and develop definitions of the terms. She also felt that there seemed to be agreement about the major drivers in the system. Overall, Mueller-Solger said that she thought the largest issue was an over abundance of engineering and an under-abundance of science and understanding of the system.

Mount pointed out that language matters and needs to be used with precision, particularly for the following terms: drivers, pressures, stressors, and threats. Mount also replied to an earlier comment by Collier that they are reinventing the tools/approaches, and every time that is done, the hard decisions are not made. The answers and decisions will not be unanimous since there are fundamental scientific differences, so there is a need to remember that and incorporate it. And in reply to an earlier public comment by B.J. Miller, Mount asked "What if it is one thing? How do you then deal with that?" Answering his own question, he said you test that hypothesis by holding everything else constant and change the one thing (example: flow). "Ultimately, we're stuck and cannot do it; we just cannot afford to test the hypothesis."

Lindley highly recommended reviewing and possibly using the framework of Harwell and Gentile. He felt that what they put together was good and offers terminology for drivers, stressors, goals, and contingencies.

Houde stated that the Delta ISB needs to make firm recommendations for near, mid- and long-term time frames, and put the stressors into time categories. He also noted that the Delta ISB lacks social scientists.

7. Public Comment (For matters that were not on the agenda, but within subject matter jurisdiction of the Delta ISB.)

B.J. Miller, San Luis & Delta Mendota Water Authority: Stated that the delta smelt was the "driver" for ranking stressors. He suggested sorting through stressors for all four listed fish species and determining which stressors apply to which species.

Victoria Poage, US Fish & Wildlife Service: stated “go bold or go home.”

Diana Engle, Larry Walker & Associates: indicated that there will be economic and water acquisition winners and losers and that compromises with the ecosystem will need to be made. She asked if there is something that could be let go of that would not lead to catastrophe.

Adjourn

Day 2: January 13, 2011 (8:30 a.m. – 5:00 p.m.)

1. Welcome

The meeting was called to order at 8:30 a.m., January 12, 2011, by the Chair of the Delta ISB, Dr. Richard Norgaard. Seven members of the Delta ISB were present for the meeting: Tracy Collier, Edward Houde, Michael Healey, Judy Meyer, Richard Norgaard, Vince Resh, and John Wiens. Absent from the meeting were Brian Atwater, Elizabeth Canuel and Jeffrey Mount.

2. Purpose and Format for Conduct of the Meeting

This was the second day of the Delta ISB Stressors Workshop held in response to requests from some members of the California Senate, Assembly and the Delta Stewardship Council (Council) for a listing and prioritization of Delta stressors. The goal of this second day was to begin preparation of a synthesis report intended to respond to those requests and to assist the Council in identifying approaches for addressing multiple stressors in the Delta.

Healey presented the main themes from Day 1 of the workshop:

1. Clarify goals and objectives for the Delta Plan. Stressors cannot be prioritized without clearly specified goals and objectives
2. Specify stressors relevant to goals. Language is important. Consider meaning of words like stressor, driver, and threat.
3. Develop conceptual models that link stressors to objectives (DRERIP, other models). Consider relevant end points as performance indicators.
4. Categorize stressors as suggested by Mount. Prioritize stressors using weight of evidence, multiple lines of evidence, expert judgment. Consider relevance of other approaches (EPA, DRERIP, South Florida, etc.) Note broad agreement on the importance of some stressors (flow regime, nutrient regime, etc.)

Comments from the Delta ISB on Healey’s main themes from Day 1:

Wiens stated that the Delta ISB needs to consider targets as well as goals, as stressors will more likely be linked to targets. There should be a number of goals, sub-goals, etc. with targets at each level.

Healey pointed out that the report or memo from the workshop should focus on a small set of strategic recommendations, without a lot of detail.

Meyer brought up the need to consider the spatial and temporal variations of stressors.

Norgaard suggested that the memo could be structured as a five-page strategic memo and/or as a longer 15-page report. The longer report might be more useful to other scientists as it would address how to implement the recommendations contained in the five-page strategic memo. Collier thought they should focus more on the five-page strategic memo, and leave it to the Science Program to assist with implementation. Houde suggested that they could add a conceptual diagram to add more information without adding to the length of the document. Wiens did not think that the Delta ISB needed to go into great detail about how to implement, but just needed to reference the appropriate materials. Wiens said that broad goals, targets and stressors are linked, and that goals and targets need to be clarified in order to identify the stressors, but that identifying specific stressors or targets is beyond what should be done in a memo. Dahm explained that the statute identifies coequal goals, and the Delta Stewardship Council is attempting to identify sub-goals. Dahm stated that identifying a process for how stressors might relate to these sub-goals might be useful but not much more is needed at this time.

Meyer stated that Day 1 of the workshop focused primarily on a discussion of ecosystems. She then asked if the Delta ISB was going to discuss water supply reliability and social aspects. She suggested that the concepts they developed for the ecosystem could also be developed for water supply.

Resh said that the bins that Mount suggested could also be used for water supply, levees and earthquakes – which are certainly stressors for water supply.

Healey stated that the Delta ISB needs to tell the Council that measurable objectives are important, and that they need to be associated with measurable targets. Norgaard replied that the Delta ISB should also tell the Council that the Bay-Delta is a dynamic system with emerging properties, and due to its complexity, increased monitoring and greater specification of targets is needed. Wiens said that there is a need to provide guidance regarding identifying and prioritizing stressors.

Healey stated that yesterday the Delta ISB talked about ways to prioritize stressors. Now, the Delta ISB needs to tell the Council which prioritization methods should be used. Collier asked if the Delta ISB was going to prioritize stressors and stated that they should emphasize using a transparent process and include a diverse stakeholder community. He also stated that he had seen efforts that failed because of the lack of transparency. Healey said that this is what BDCP has tried to do and that the various stakeholder groups are not able to go beyond the self-interested fights. Healey thought that at an initial stage, the Council might need to engage with small

groups to do some type of prioritization and work from that. The Delta ISB can provide advice/methodology/clarity on how to prioritize stressors but due to the limited timeframe they are unable to do the prioritization. Houde said that they identified three to four drivers and the Delta ISB should give advice on how to gain understanding of those drivers. Therefore, perhaps the memo should focus on the drivers as they might be helpful in assigning stressors to bins.

Wiens reminded the group of the importance of the temporal and spatial aspects of some of the stressors.

Norgaard felt the Delta ISB should remain open to the possibility of a 15-page report that they would work on in a six-week-to-three-month timeframe as he did not feel that a five-page strategic memo would calm the discourse.

Dahm reminded the Delta ISB members that two different audiences requested the memo/report: the Delta Stewardship Council and some members of the Legislature. The focus from the legislators was on stressors on native fish whereas the focus of the Council was on the Bay-Delta as an entire system. Dahm suggested that they may not want to use the term “prioritize”.

Healey asked if the Delta ISB could identify a set of stressors that are the most important to the State and/or deserve more research. Wiens said that the Delta ISB probably could, but the risk is that those that are not identified would be forgotten. He also stated that the Delta ISB should identify target-based stressors using the approaches they discussed the previous day and perform an assessment.

Healey stated that the Delta ISB needs to address how terms are used, that sources of stress and the stressors might be different depending on the subject such as water supply, ecosystems, or Delta as place.

3. Prepare Draft Stressors Report

- a. Break into small group work session(s)
- b. Report out to larger group
- c. Repeat as necessary

Healey suggested organizing the memo around seven topic areas:

1. Clarify goals and objectives for the Delta Plan. Stressors cannot be prioritized without clearly specified goals and objectives.
2. Specify stressors relevant to goals. Language is important. Consider the meaning of words like stressor, driver, and threat.
3. Develop conceptual models that link stressors to objectives (for example, DRERIP). Consider relevant end points as performance indicators.

4. Categorize stressors as suggested by Mount. Prioritize stressors using weight of evidence, multiple lines of evidence, and/or expert judgment. Use criteria such as the Board began developing on the previous day.
5. Consider relevance of other approaches (EPA, DRERIP, South Florida, etc.) Note broad agreement on the importance of some stressors (flow regime, nutrient regime, etc.).
6. Take account of the fact that inexorable change is occurring in the Delta. Stressor assessment must be in the context of what the Delta environment is likely to be 30 to 50 years in the future. (E.g., levee collapse, changes in hydrology and water supply, new invasive species, etc.)
7. In implementing management, recognize that expected outcomes are highly uncertain. Employ adaptive management tools to learn from implementation.
8. Expect surprises.

Based on these seven topic areas, the Delta ISB broke into small groups to work as follows:

Topic 1 – Norgaard, Healey

Topics 2 & 3 – Wiens (diagram), Houde, Resh

Topic 4 – Meyer and Collier

Topic 5 – Norgaard, Healey

Topic 6 – Norgaard, Healey

Recommendations to groups as they work on these tasks:

1. Stress measurable objectives with endpoints that can be used as indicators.
2. Emphasize that changing conditions will complicate management of the Delta, and that future conditions will need to be addressed.
3. More monitoring will be needed because of changing conditions, and that monitoring will need to be more extensive and better designed.
4. Use Mount's bin plus Norgaard's additional future bin to categorize stressors – this will help how categorization, and variations in time and space are thought of.
5. Consider the source of stress as well as the stressor.
6. Although they might be able to prioritize some stressors, a process will be needed.
7. Address how terms are used.

Public Comment:

Connie Ford, Sacramento County Water Agency: Ford said that from her perspective, the Delta ISB needs to have an awareness of the fact that the Delta Plan is an implementation plan and needs to be founded on good science that makes sense to all those who will be affected by it such

as landowners, municipal and agricultural communities, and industrial operators. Change is possible if the public is made aware of why change is needed.

Cliff Dahm, Delta Science Program: The Delta Stewardship Council is scheduled to meet on Jan. 27 and 28 and a number of the items on the agenda will have a science focus. The Delta Science Program Lead Scientist report will include a discussion of the 2010 PSP grant selection process, and as requested by the Council, a review of climate indices and precipitation. Hastings will present for approval by the Council, the budget for the online journal and the Fellows Program. Also, Norgaard will provide the Delta ISB Chair's report.

After Lunch

- Work on assignments -

4. Recap the day's work and discuss Next Steps

Norgaard provided a brief reporting out to the public stating that the Delta ISB would prepare two products as a result of this meeting. The first would be a short five- page memo that would be more strategic in purpose. The second product would be a follow-up to the short five-page memo and provide greater explanation regarding the scientific process needed to carry out the recommended strategy. Current efforts are underway to produce the first of the two documents. Norgaard estimated that about six weeks would be needed to prepare and finalize the longer report.

Ford discussed the proposed schedule for producing the memo:

Date	Action
Jan 14 (Fri)	ISB members send their respective sections to Norgaard and Healey for collation.
Jan 18 (Tues)	Healey and Norgaard send draft to Delta Science Program staff (Ford, Brand, and Soderstrom)
Jan 19 (Wed)	Delta Science Program staff sends draft to all Delta ISB Members
Jan 21 (Fri)	Delta ISB members send any comments to Healey and Norgaard as well as to the Delta Science Program staff by noon
Jan 24 (Mon)	Consolidated comments sent to Delta ISB and a teleconference (12:30-2:30) is scheduled to take any verbal comments (from public or Delta ISB members); Delta ISB members vote to approve report conditionally on all agreed upon edits being incorporated by Norgaard and Healey
Jan 25 (Tues)	Norgaard and Healey make all final edits and send to Delta Science Program staff
Jan 26 (Wed)	Delta Science Program staff completes grammar/spelling/ formatting
Jan 27 (Thurs)	Submitted to Delta Stewardship Council by Delta Science Program staff
Jan 28 (Fri)	Norgaard presents report to Stewardship Council

5. Public Comment (For matters that were not on the agenda, but within subject matter jurisdiction of the Delta ISB.)

Norgaard provided the public present the opportunity to comment, and no comments were made.

6. Preparation for next Delta ISB meeting

The next scheduled meeting of the Delta ISB is a teleconference on January 24 from 12:30 to 2:30 p.m. PST to finalize the memo to the Delta Stewardship Council. In preparation for that meeting, the following tasks were assigned to the Delta ISB members:

Delta ISB Member(s)	Assignment/Tasks
Norgaard	Clarify goals and objectives for Delta Plan. Stressors cannot be prioritized without clearly specified goals and objectives.
Wiens, Resh, Houde	Specify stressors relevant to goals. Language is important. Consider meaning of words like stressor, driver, and threat. Create a diagram and language to explain it. Develop conceptual models that link stressors to objectives (DRERIP, other models). Consider relevant end points as performance indicators.
Meyer, Collier	Categorize stressors as suggested by Mount. Prioritize stressors using weight of evidence, multiple lines of evidence, and expert judgment. Use criteria like what had begun being developed during this meeting. Consider relevance of other approaches (EPA, DRERIP, South Florida, etc.) Note that there was broad agreement on the importance of certain stressors (flow regime, nutrient regime, etc.).
Healey	Take account of the fact that inexorable change is occurring in the Delta. Stressor assessment must be in the context of what the Delta environment is likely to be 30 to 50 years into the future. (E.g., levee collapse, changes in hydrology and water supply, new invasive species, etc.) In implementing management, recognize that expected outcomes are highly uncertain. Employ adaptive management tools to learn from implementation. Explain that surprises should be expected.
All ISB Members	Report out on any additional recommendations.

Adjourn